

ME 260: Structural Optimization: Size, Shape, and Topology		
Assigned: Oct. 22, 2021	Quiz 5	Due: Oct. 122, 2021

Multiple Choice Questions

[Conducted using Poll Everywhere in the recitation class on Oct. 22nd, 2021]

- (i) Transversality of the solution function with the variable boundary applies when the integrand F is... (choose all that apply)
 - a. $\sin(y) \cdot \sqrt{1+y'^2}$
 - b. $\log(y) / \sqrt{1+y'^2}$
 - c. $(y^2+y) / \sqrt{1+y'^2}$
 - d. $(y^2+y') \cdot \sqrt{1+y'^2}$
- (ii) Weirstrass-Erdmann corner conditions lead to which optical phenomena (choose all that apply)?
 - a. Reflection
 - b. Refraction
 - c. Dispersion
 - d. Diffraction
- (iii) Choose a physical scenario for transversality conditions where the integrand is of the form $F(x,y,z,y',z')$ where y and z are functions of x and the bounds, x_1 and x_2 are function of y and z .
 - a. A circular plate with fixed edges and load at the centre
 - b. A beam with its ends resting on a 3D surface with loads in multiple transverse directions
 - c. A membrane adhering to a 3D loop of a wire (as a soap bubble would do)
 - d. A bulky solid resting on a rugged domain
- (iv) When the boundary of a domain in a calculus of variations problem are variable, the nature of the differential equation and the solution remains unchanged from what it is for non-variable boundary.
 - a. True
 - b. False
- (v) For which of these integrands of a functional, would the first integral exist?
 - a. $y \cdot y'$
 - b. $y \cdot y''$
 - c. y'/y
 - d. $y \cdot y'^2$
- (vi) Which of the following principles are within the scope of deriving from the calculus of variations?
 - a. Conservation of energy
 - b. Conservation of linear momentum

- c. Conservation of angular momentum
- d. Conservation of mass
- (vii) For any functional with an invariant one-parameter transformation, the first integral can be obtained.
 - a. True
 - b. False
- (viii) Which of the following statements is true?
 - a. Symmetry of a differential operator implies self-adjointness.
 - b. Self-adjointness is a necessary condition for writing a functional to be optimized to get the differential equation.
 - c. Self-adjointness is a sufficient condition for writing a functional to be optimized to get the differential equation.
 - d. Only conservative systems are amenable to derive a functional to be optimized from the differential equation.
- (ix) Which term in the integrand of a functional will annul the contribution of fy''' in the Euler-Lagrange equation?
 - a. $f'''y''$
 - b. $f''y''$
 - c. $f'y''$
 - d. fy''